

Changes in hydrological extremes: advances in climate-induced extremes focusing on a small north Atlantic Island

Summary

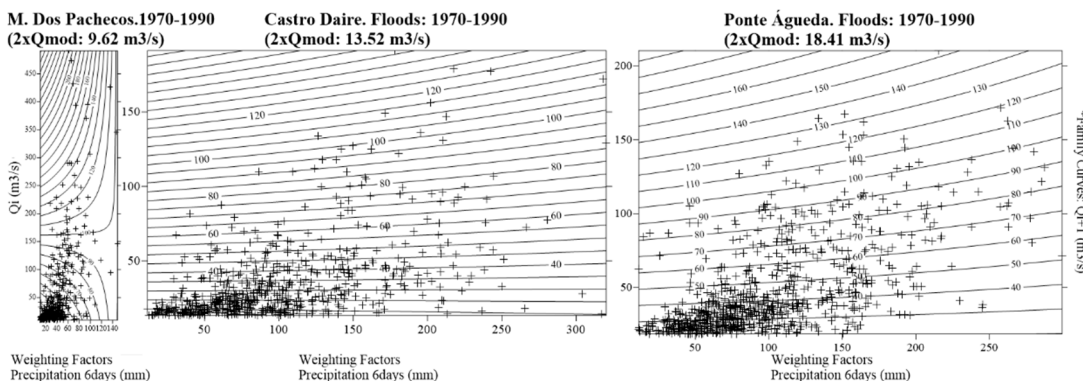
The main objective of this research is the development of a theoretical/conceptual approach, although based on different case studies. It will be related to the analysis of extreme natural hydrological events, their characteristics, modelling and relationship with climatic drivers such as teleconnection indexes. Although the significance of extreme hydrological natural events and their associated changes is widely acknowledged, the comprehensive understanding is still missing. Hence, the research supports a wide range of approaches according to the specific envisage targets.

Some of the approaches the will be considered for this research will be: (i) a comprehensive characterisation of the signal of change in regions with a poor knowledge or understanding about issues or in regions with scarcity of the required data to address it, (ii) detection, characterisation, and modelling of changes, for instance trend analysis, that may occur both in magnitude and frequency of extreme events, (iii) it is desirable to analyse the phenomena based on stationarity- and non-stationarity approaches, (iv) to search relationships of the effect on climate change, and (v) characterisation of the phenomena at multi spatial scales. As a first attempt to study changes in hydrological extremes, the natural phenomenon studied was flooding associated to intense precipitation in three continental catchments in Portugal with different climatic characteristics but similar size: Monte Dos Pachecos in the south, Ponte Águeda and Castro Daire northern Portugal. A flood forecasting method, which has never been used in Portugal, was proposed.

The main goal of this study was to set up a method with an optimal structure, limited by the available data and techniques implemented, to forecast floods using nomographs solutions of Monte Dos Pachecos-, Castro Daire-, Ponte Águeda gauges. The use of nomographs had never been applied to Hydrology context in Portugal. This method enables to make forecasts for the next day and the next 12- to 4 hours for Ponte Águeda with uncertainties of 30%, 36%, and 10% respectively. The lessons learnt from the studied continental catchments will be taken to river basins in a different context such as islands. Madeira island will be under study by the student as hydrological extreme events are relevant in that area. Hydrometeorological data from different gauges and a digital elevation model will be needed primarily. The following research question was formulated during the collection of data in Madeira "is the presence of extreme hydrological events getting more frequent in Madeira island?".

Keywords

Extreme hydrological events, climate change, floods, extreme rainfall events, forecasting, nomographs.



Nomographs of three continental Portuguese catchments using antecedent precipitation and discharge.



PhD student

Luis Angel Espinosa Villalpando

PhD program

Civil Engineering (IST, University of Lisbon)

Supervisor

Manuela Portela (CERIS, IST, University of Lisbon)

Co-supervisor

Rui Rodrigues (LNEC)

Period

2017-2021

Funding

FCT scholarship (PD/BD/128509/2017)